

(12) UK Patent Application (19) GB (11) 2 012 727

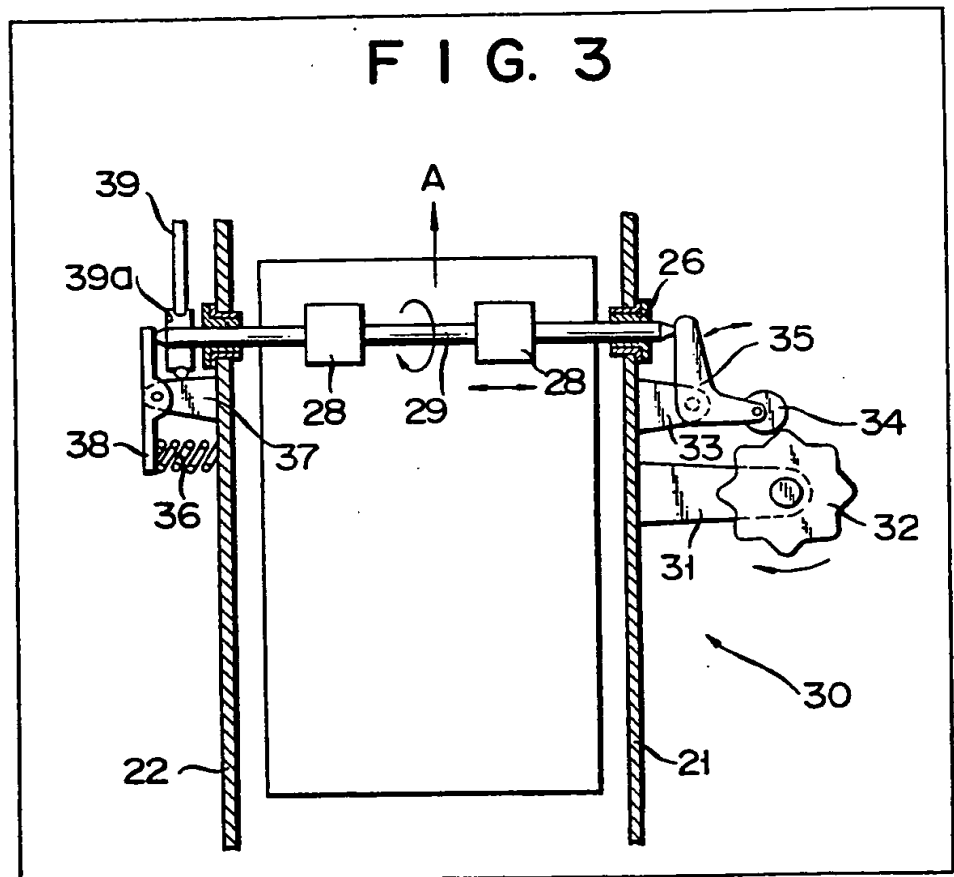
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(21) Application No 7839521
(22) Date of filing 5 Oct 1978
(23) Claims filed 5 Oct 1978
(30) Priority data
(31) 53/003683
(32) 19 Jan 1978
(33) Japan (JP)
(43) Application published
01 Aug 1979
(51) INT CL³
B65H 3/06 3/62
(52) Domestic classification
B8R 403 451 471 AJ6
(56) Documents cited
None
(58) Field of search
B8R
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(54) Vibratory paper feed device

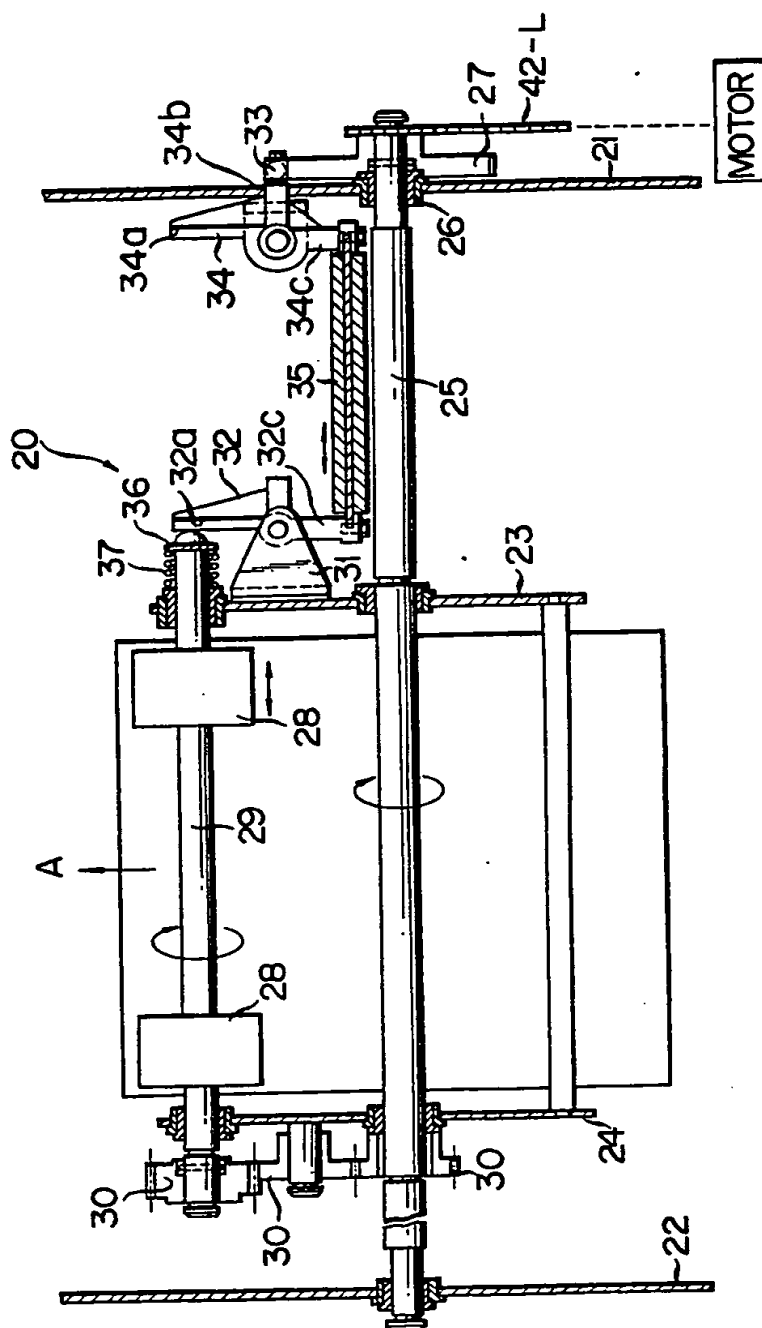
(57) A paper feed device comprises support frames 21, 22 disposed parallel to each other, and a rotation shaft 29 journaled in the support frames and upon which feed rollers 28 are fitted. The feed rollers 28 are imparted with vibrations in a direction perpendicular to the paper feed direction. Thus single sheets of paper may be fed from a pile by the rotation of the vibrating paper feed rollers 28 located thereabove.



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SPECIFICATION

Automatic paper feed device

- 5 This invention relates to an automatic paper feed device for electronic copying machines etc. Which is adapted to cause papers of a paper stock on a tray to be fed one by one by paper feed rollers without involving a "double feed".
- 10 Generally such an automatic paper feed device has a "double feed" problem, a state that papers are doubly fed in superposed or overlapped manner. This may cause jamming of papers to occur inside a copying machine.
- 15 With the conventional copying machine, papers need to be set, after carefully reshuffled, on a tray so that no "double feed" may occur. Furthermore, a separation finger is provided at each side of the forward and portion of a paper stock so as to permit a
- 20 paper to be separated from the next adjacent paper. In this case, however, a cumbersome reshuffling operation is necessary. Moreover, there is also a risk that a "double-or triple-feed" will occur. This will cause jamming of papers to occur inside the copying machine, thus lowering an operation efficiency.
- 25 It is accordingly the object of this invention to provide a very efficient, automatic paper feed device adapted to impart vibration to paper feed rollers in a direction perpendicular to a direction of travel of a paper fed by the rotation of the paper feed rollers, to cause an uppermost paper to be positively separated from the next adjacent paper of a paper stack to permit papers to be fed one by one without involving any double feed and without a cumbersome paper reshuffling operation.
- 30 This invention is further described by way of example by referring to the accompanying drawing in which:
- Fig. 1 is a schematic view showing an electrophotographic copying machine;
- Fig. 2 to 4, each, are a plan view showing a vibration imparting mechanism of a paper supply device according to this invention; and
- Fig. 5 is a perspective enlarged view showing a wavy disc of Fig. 4.
- 35 In Fig. 1, reference numeral 1 shows a body of an electrophotographic type electronic copying machine. The machine body 1 has a document glass 2 at the upper end. Inside of the machine body 1 is disposed a drum type photosensitive member 3 around which a charging unit 4, exposure unit 5, developing unit 6, transfer unit 7, cleaning unit and so on are arranged along the rotation direction of the photosensitive member 3. An automatic paper feed device 9 is disposed at one corner of the interior of the machine body 1 and a fixing unit 10 and paper delivery rolls 11 are disposed at the opposite corner of the interior of the machine body 1 with the transfer unit 7 interposed between the automatic paper
- 40 feed device 9 and the fixing unit 10.
- The photosensitive member 3, while being rotated, is charged by the charging unit 4, a document on the document glass 2 is exposed by an exposure unit 5 to cause an electrostatic latent
- 45 image to be formed on the outer peripheral surface

- of the photosensitive member 3. The developing unit 6 attaches a developer such as a toner etc. to the outer peripheral surface of the photosensitive member 3 to cause the electrostatic latent image on the surface of the photosensitive member 3 to be converted into a visual image. The visual image is transferred to a paper fed from the automatic paper feed device 9. The image on the paper is fixed by the fixing unit 10 and the fixed image bearing paper,
- 50 after passed through a nip between the delivery rollers 11, is delivered to the outside. The photosensitive member 3 is cleaned by the cleaning unit 8 ready for the next cycle. Thus, one copying operation is terminated. Such operations are repeated according to the number of document sheets. The automatic paper feed device 9 includes a paper stock tray 13, a spring 12 disposed under the tray 13 to cause the tray 13 to be upwardly urged, and a pair of paper feed rollers 28. The automatic paper feed device 9 is
- 55 such that, each time a copying cycle is effected, a suitable frictional rotation force is imparted by the roller to the top surface of a paper stock on the upwardly spring-urged tray to cause the papers to be fed one by one toward the photosensitive member 3.
- 60 In order to prevent a possible "double feed" the above-mentioned automatic paper feed device includes a vibration imparting means, as shown in Fig. 2 to 4. The vibration imparting mechanism is adapted to impart vibration to the top surface of the paper stock on the tray in a direction of the axis of the paper feed rollers i.e. in a direction perpendicular to the direction A of travel of the paper which is fed by the rollers.
- 65 A vibration device 20 according to one embodiment of this invention comprises a pair of support frames 21, 22 parallelly disposed above the paper feed device 9 which is placed within the body of the copying machine; a pair of support subframes 23, 24 parallelly disposed to leave a spacing therebetween which is somewhat wider than the width of the papers on the tray, each of the subframes having a restricted length; a drive shaft 25 journaled in bearings 26 on the subframes 23, 24 and frames 21, 22; a drive cam 27 having concave and convex portions alternately at its outer periphery, and mounted on the bearing 26 on the support frame 21 to drive the drive shaft 25, the drive cam 27 being adapted to be driven by a drive source (not shown) in the machine body; a rotation shaft 29 mounted between the subframes 23, 24, adapted to be driven by the drive shaft 25 through a spur gear wheel 30 which is mounted at the subframe side 24 and between the end portion of the drive shaft 25 and the end portion of the rotation shaft 29, and having a pair of paper feed rollers 28; a first T-shaped rotation level 32 rotatably mounted on a bracket 31 which is in turn mounted on the subframe 23, a first T-shaped rotation lever 34 rotated through a roller 33 in rolling engagement with the drive cam 27, and including an arm portion 34b extending normally parallel to the drive shaft 25 and having the above-mentioned roller 33 at the forward end and an arm portion 34C connected to the later-described interlocking arm; a second T-shaped rotation lever 32 having an arm portion 32a constantly in contact with the end of the rotation shaft 29 and an
- 70 the surface of the photosensitive member 3 to be converted into a visual image. The visual image is transferred to a paper fed from the automatic paper feed device 9. The image on the paper is fixed by the fixing unit 10 and the fixed image bearing paper,
- 75 after passed through a nip between the delivery rollers 11, is delivered to the outside. The photosensitive member 3 is cleaned by the cleaning unit 8 ready for the next cycle. Thus, one copying operation is terminated. Such operations are repeated according to the number of document sheets. The automatic paper feed device 9 includes a paper stock tray 13, a spring 12 disposed under the tray 13 to cause the tray 13 to be upwardly urged, and a pair of paper feed rollers 28. The automatic paper feed device 9 is
- 80 such that, each time a copying cycle is effected, a suitable frictional rotation force is imparted by the roller to the top surface of a paper stock on the upwardly spring-urged tray to cause the papers to be fed one by one toward the photosensitive member 3.
- 85 In order to prevent a possible "double feed" the above-mentioned automatic paper feed device includes a vibration imparting means, as shown in Fig. 2 to 4. The vibration imparting mechanism is adapted to impart vibration to the top surface of the paper stock on the tray in a direction of the axis of the paper feed rollers i.e. in a direction perpendicular to the direction A of travel of the paper which is fed by the rollers.
- 90 A vibration device 20 according to one embodiment of this invention comprises a pair of support frames 21, 22 parallelly disposed above the paper feed device 9 which is placed within the body of the copying machine; a pair of support subframes 23, 24 parallelly disposed to leave a spacing therebetween which is somewhat wider than the width of the papers on the tray, each of the subframes having a restricted length; a drive shaft 25 journaled in bearings 26 on the subframes 23, 24 and frames 21, 22; a drive cam 27 having concave and convex portions alternately at its outer periphery, and mounted on the bearing 26 on the support frame 21 to drive the drive shaft 25, the drive cam 27 being adapted to be driven by a drive source (not shown) in the machine body; a rotation shaft 29 mounted between the subframes 23, 24, adapted to be driven by the drive shaft 25 through a spur gear wheel 30 which is mounted at the subframe side 24 and between the end portion of the drive shaft 25 and the end portion of the rotation shaft 29, and having a pair of paper feed rollers 28; a first T-shaped rotation level 32 rotatably mounted on a bracket 31 which is in turn mounted on the subframe 23, a first T-shaped rotation lever 34 rotated through a roller 33 in rolling engagement with the drive cam 27, and including an arm portion 34b extending normally parallel to the drive shaft 25 and having the above-mentioned roller 33 at the forward end and an arm portion 34C connected to the later-described interlocking arm; a second T-shaped rotation lever 32 having an arm portion 32a constantly in contact with the end of the rotation shaft 29 and an
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each other; a rotation shaft journaled in the first and second support frames and having paper feed rollers, and a vibration imparting mechanism for imparting vibration to the paper feed rollers in a direction perpendicular to a direction of travel of paper.

5 2. An automatic paper feed device according to claim 1 in which said vibration imparting mechanism comprises a cam having an equidistantly concave and convex portions alternately at its outer periphery, a roller in rolling contact with the concave and convex portions of the cam, a member for imparting a vibratory force resulting from a rolling contact of the roller with the cam to the rotation shaft, and means for imparting a counter urging force to the rotation shaft.

3. An automatic paper feed device according to claim 2 in which said imparting member comprises a first swingable lever having a roller in rolling contact with the cam at one end, a second swingable lever whose one end is normally in contact with the rotation shaft, and a connection rod connecting the other end of the first swingable lever to the other end of the second swingable lever.

25 4. An automatic paper feed device according to claim 3, further comprising spur gear wheel for transmitting drive force to the rotation shaft.

5. An automatic paper feed device according to claim 4 in which said urging means has a compression spring around one end portion of the rotation shaft to urge the rotation shaft toward the second lever.

6. An automatic paper feed device according to claim 2 in which said imparting member has a 35 L-shaped swingable lever supported on the first support frame, one end of the lever having said roller and the other end of the lever being normally in contact with the rotation shaft, said shaft is urged toward the other end of the lever by said urging means.

7. An automatic paper feed device according to claim 6 in which said urging means has a vibration imparting lever disposed on the second support frame and having one end portion normally in contact with the rotation shaft and the other end portion against which a compression spring is disposed so as to anchor it between the other end portion of the lever and the second support.

8. An automatic paper feed device according to 50 claim 2 in which said vibration imparting member comprises a wavy disc mounted on one end portion of the rotation shaft and a pair of rolling balls between which the wavy disc is disposed such that it can be vibrated.

9. An automatic paper feed device according to 55 claim 2 or 7 in which the rotation shaft is driven by a V-pulley and V belt.

10. An automatic paper feed device, substantially as hereinbefore described with reference to the 60 accompanying drawings.